German High Tech Champion 2012

Light-weight metal-monocoque vehicle body

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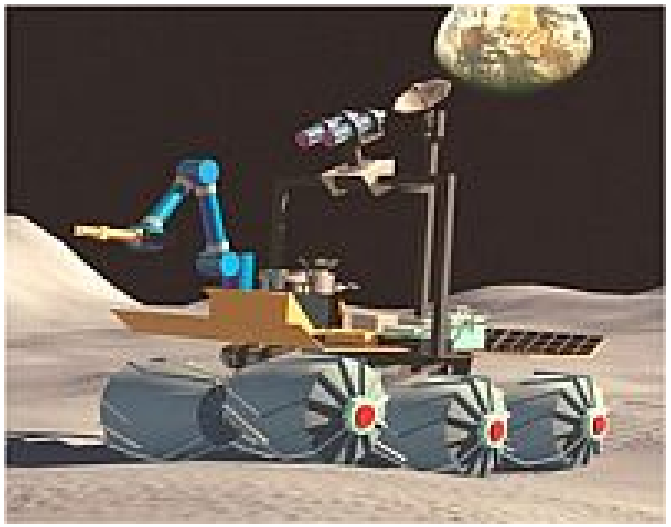
Vehicles of the German Aerospace Center ?

Lunar rover



Aircraft for flight testing

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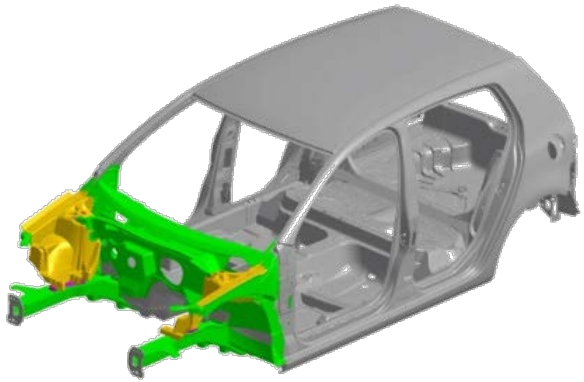
DLR Institute of Vehicle Concepts

Lightweight & Hybrid Design Methods



- Development of resource-efficient, novel vehicles

- Safe, light and cost-effective vehicle concepts

- Adaptation to alternative drive train concepts

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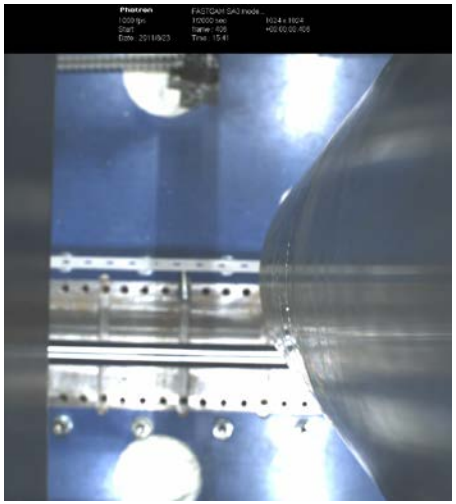
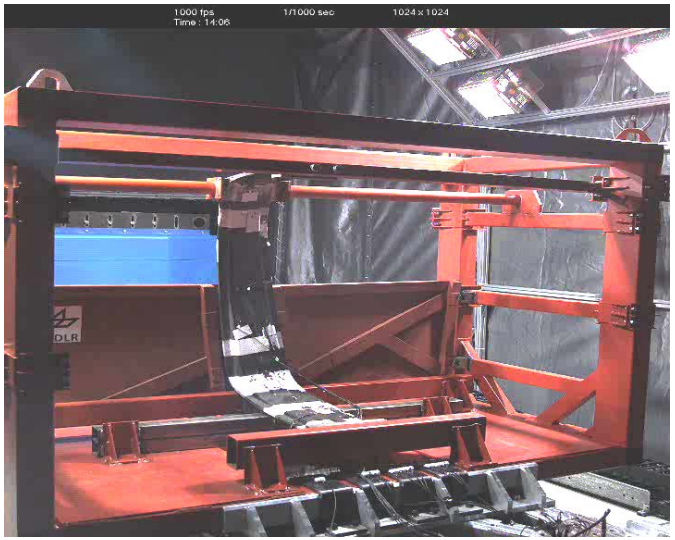
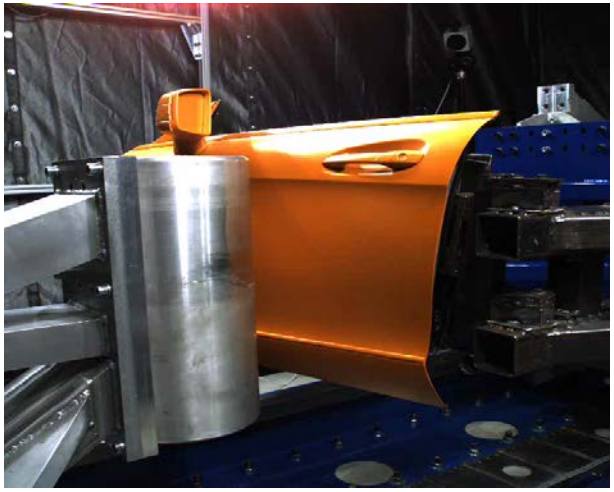
Lightweight & Hybrid Design Methods

Passive safety / crash simulation and testing







Motivation for the metal monocoque body

Politics, Society / Environment und legislation

- Shortage of resources
- Climate change
- Population and mobility growth

- Decrease of consumption and emissions
- Increasing demand for more efficient mobility

Source: wanttoknowaboutindia.blogspot.com/ 2011/04/car...

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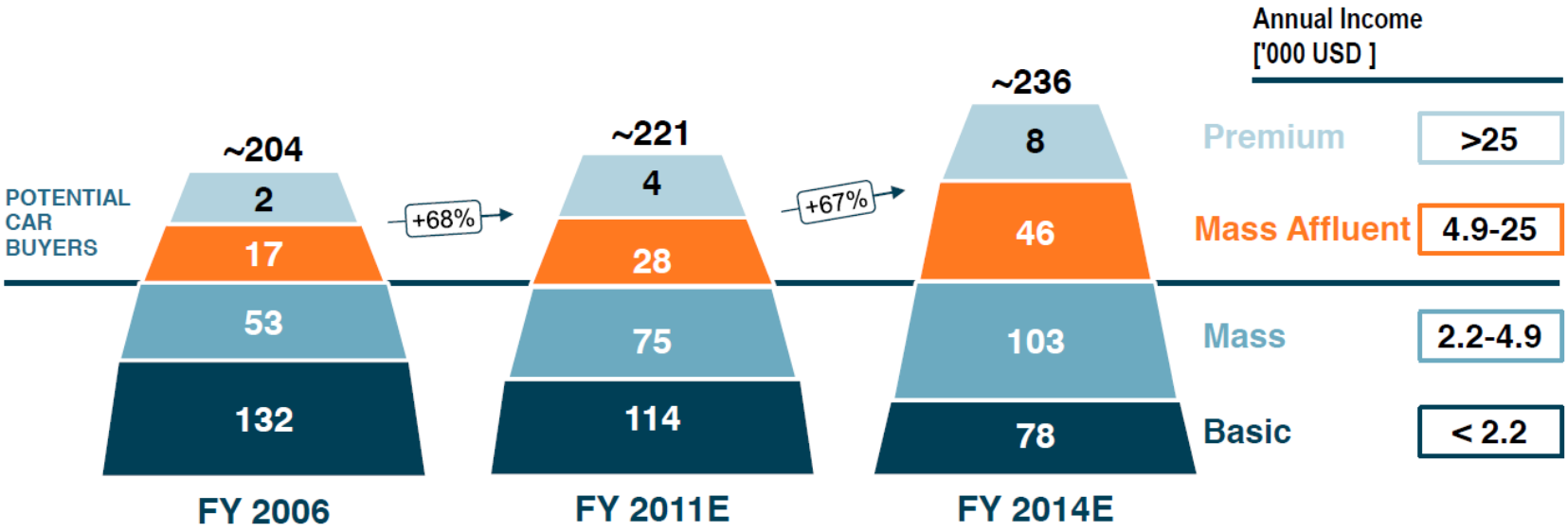
Potential car buyers in India

Income pyramid - India [Mio households]



67% increase in the population of potential car buyers projected by FY 2014

Source: NCAER, Tata Strategic & Roland Berger analysis

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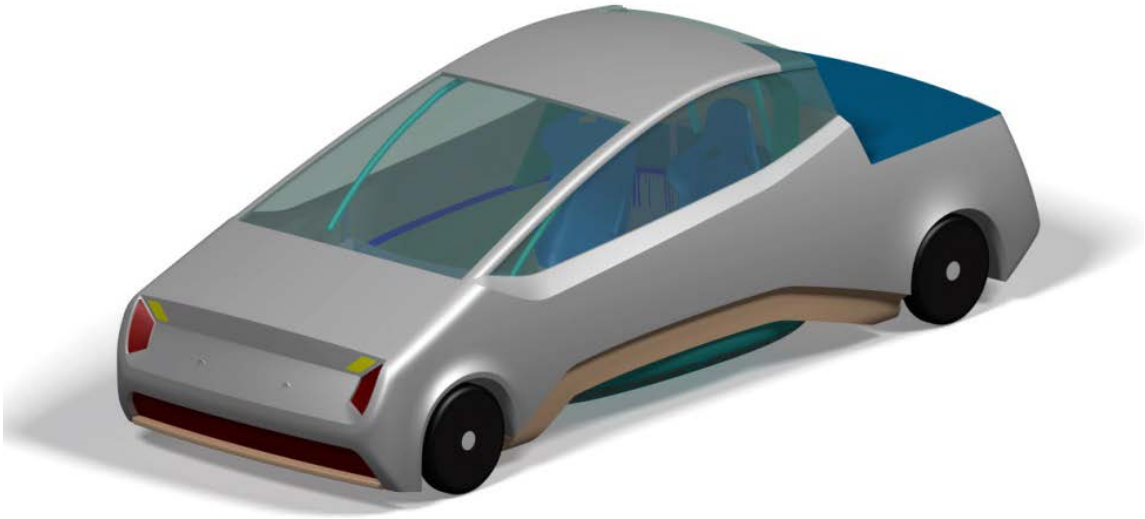
Metal monocoque development

- Very low weight
- High crashworthiness
- Low investment costs
- Low initial requirements for production facilities
- Use of conventional materials (no CFRP)
- Construction method similar to a race car



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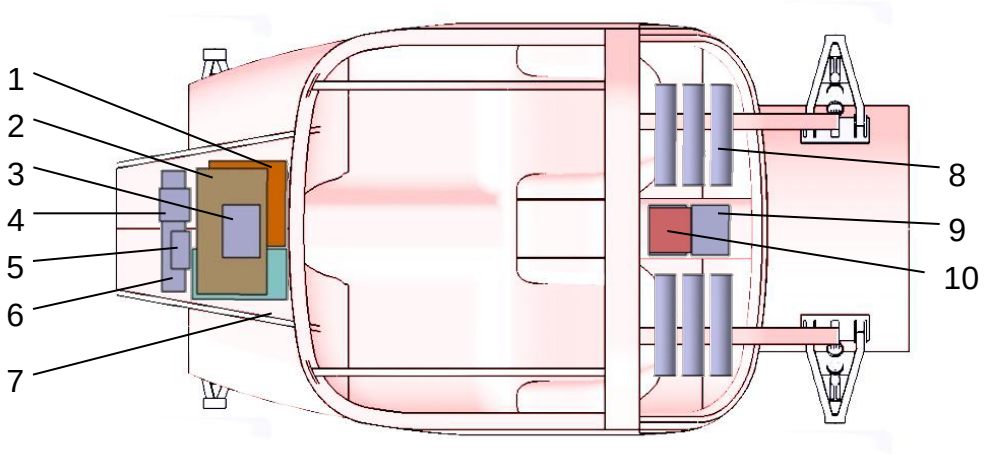
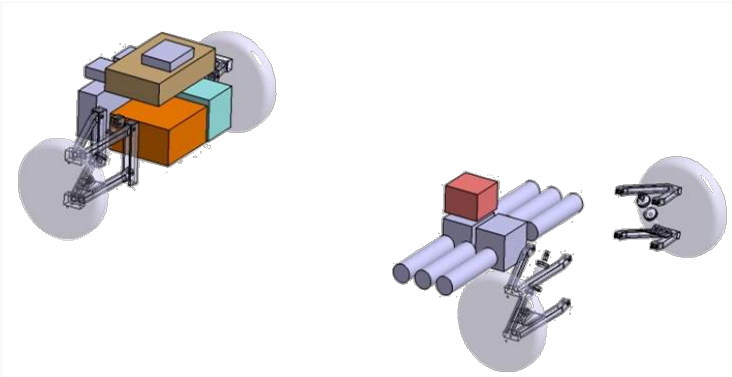
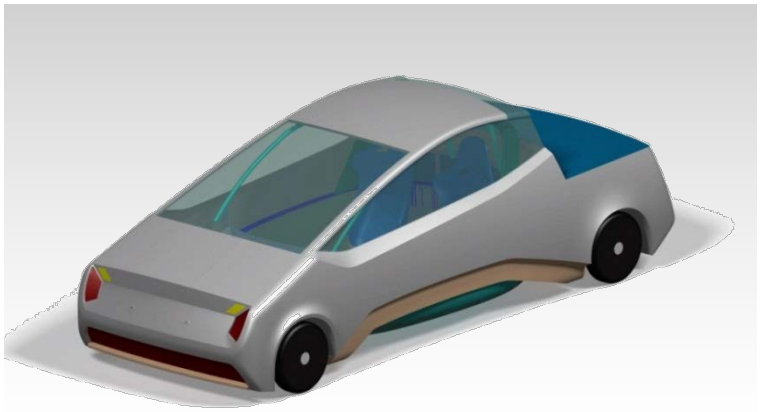
Possible positioning of drive train components (example: fuel cell drive train)

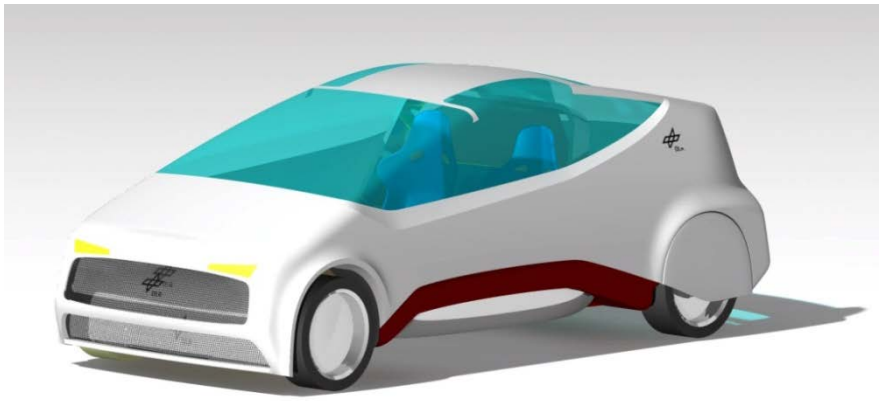
1 fuel cell
2 fuel cell control module
3 ECU for electric motor
4 ECU for lighting
5 ECU for cooling
6 cooling module
7 air supply module
8 H_2 -storage
9 batteries
10 H_2 -supply-module





Modular body shell





- Plastic body shell, similar to race-cars
- Underlying structure can be optimised to crash loads, no need to compromise with aerodynamics or design
- Outer shell can easily be modified without the need of changing the structure

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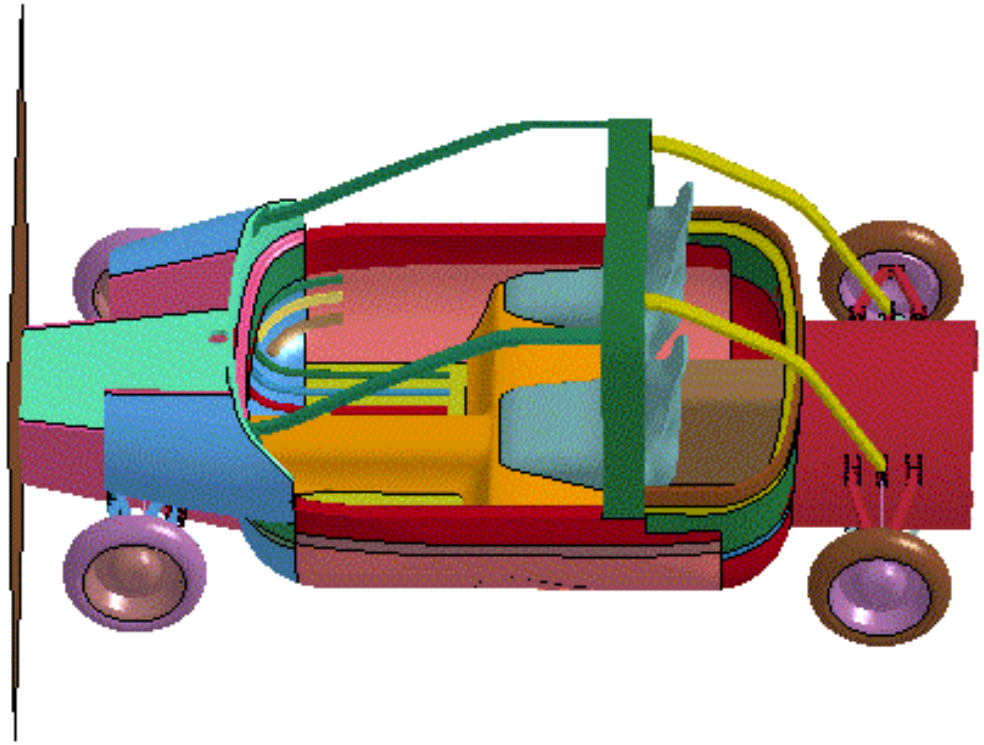
Crash-Simulation, example 1



- Damage tolerant crash-behaviour, even when overloaded, little tendency for catastrophic collapse
- **Weight of the body in white approx. 80 kg**

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Crash-Simulation, example 2

- Good overall crash behaviour under highly concentrated loads
- Low intrusion, no collapse

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Assembly and manufacture

- Part count around 40-50 parts vs. 200-300 parts in a conventional car body

- Simply shaped parts -> low costs for tooling and machinery

- Parts are made of aluminium sheets instead of expensive CFRP

- Mostly cold joining methods

Target group:

- OEMs wishing to expand their portfolio
- Component manufacturers wishing to produce an entire vehicle
- Automotive suppliers
- Companies with experience in the production of structural components that wish to enter the automotive market

Cooperation opportunities:

- Technology transfer through pilot-project for the Indian market by DLR
- Licensing of the vehicle structure and the manufacturing process

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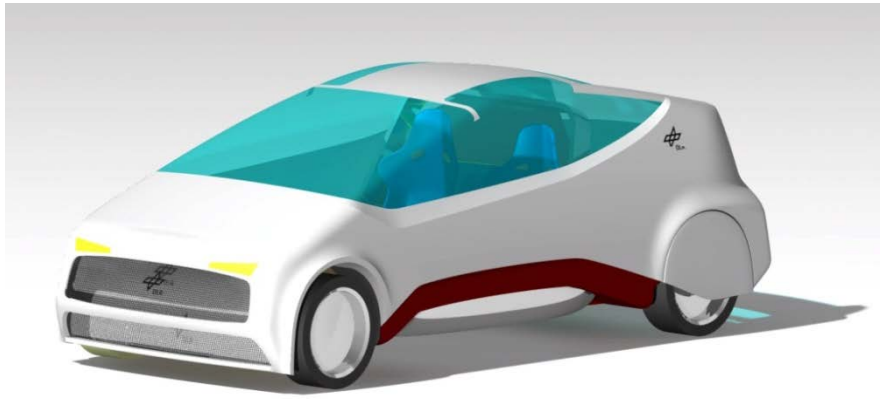

Thank you for your attention!

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